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UNIV. OF

TEACHERS' HANDBOOK

TO ACCOMPANY

SCIENCE OF HOME AND COMMUNITY

BY

GILBERT H. TRAFTON

New York
THE MACMILLAN COMPANY
1921

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I. Introduction

This Teachers' Handbook is prepared for the aid of teachers who use the author's *Science of Home and Community*. At the outset attention is called to the report on *Reorganization of Science in Secondary Schools*, prepared by the science committee of the Commission on Reorganization of Secondary Education, appointed by the National Educational Association. This report has been published as Bulletin, 1920, No. 26, of the Bureau of Education. Special attention is called to this report here because it has made a valuable contribution toward solving one of the perplexing problems of secondary education, namely the problem as to what should constitute the aims of science teaching in the high school. The general commission has set forth the main objectives of work in the secondary schools, and the science committee has adopted these objectives, which may be briefly listed as follows: health, worthy home membership, vocational guidance, citizenship, the use of leisure, and ethical character. A study of the table of contents of *Science of Home and Community* shows that the book deals with topics that clearly help fulfill these objectives.

The author has purposely included more material than can usually be covered in a year so as to allow a wider range of choice on the part of those using the book. By this means the book may be adapted to use in different types of schools. More definite suggestions are given farther on regarding the adaptation to these types.

The author has incorporated directions for field and laboratory projects within the text because he believes that such an arrangement is preferable to one in which the text and the practical exercises are printed in separate books. It is believed that the plan followed in the text has at least two distinct advantages. First, it tends toward the development of a more unified course.

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It gives greater meaning to both the text and the practical exercises to have them closely related. In some schools teachers of special sciences have fallen into the error of keeping these two parts of the course as distinct and unrelated parts, and as a result much of the laboratory work has little significance to the pupil. This practical work has a much more vital character when it is closely related to the text.

Second, the arrangement used in this text tends to encourage doing more laboratory and field work. Unfortunately in some schools general science is taught merely as a textbook subject without any practical work. Under such circumstances the subject is deprived of a large amount of its greatest value. The inclusion of directions for practical work in the text will naturally encourage a wider use of these exercises.

II. Adaptation to Different Types of Schools

For the purpose of giving suggestions regarding the use of the text, schools may be divided into three types: the large city school, the small town school, and the rural consolidated school. The fundamental principle to be applied in teaching general science is that the subject should be related intimately with the life of the pupil. The more essential differences between rural and urban schools relate to the space found in the home yard, to the kind of wild plants and animals found in the neighborhood, and to the applications of science commonly found in the locality. In rural communities more attention may be given to gardening and to the study of wild plants and animals than in the urban communities. The following suggestions are for a year's course.

1. For the large city school.
   Omit chapters 4, 11, 12, 13, 14, 15.
2. For the small town school.
   Omit chapters 4, 13, 14, 19.
3. For the rural consolidated school.
   Omit chapters 10, 17, 19, 23.

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III. Adaptation to Different Length of Courses

1. *Year courses.*

The suggestions already given under types of schools are for year courses.

2. *Half-year courses.*

A half-year course may be worked out in two ways: first, either Part I, Science of the Home, or Part II, Science of the Community, may be taken; second, choice may be made from both parts. If the second plan is followed, the following selection of chapters is suggested:

A. For large city schools.

Take chapters 1, 2, 5, 7, 8, 10, 16, 18, 20, 22, 24, 26, 28, 30, 32, 33.

B. For small town schools.

Take chapters 1, 2, 5, 8, 12, 18, 20, 22, 24, 26, 28, 30, 32, 33.

C. For rural consolidated schools.

Take chapters 1, 2, 4, 5, 8, 12, 15, 18, 22, 24, 29, 30, 33.

3. *Two year courses.*

In some schools, especially in junior high schools, there is a tendency to develop a two year course in general science. In such a course the work may be divided as follows:

First year. Part I. Science of the Home.
Second year. Part II. Science of the Community.

If five periods a week are given each year, the time will permit a more detailed discussion of the various topics than is given in the text. Time may be taken for study of additional references and for the presentation of many special reports by the members of the class.

4. *Three year courses.*

When a three year course is given extending through the 7th, 8th, and 9th grades, the plan is often followed of devoting two or three periods weekly for the first two years, and five periods for the third year. For such a combination the following allotment of topics is suggested:

First year. Science of the Home: the Home Grounds. Chapters 11–15.

Second year. Science of the Home: the Household. Chapters 1–10.

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Third year. Science of the Community: Chapters 16–33.

IV. Laboratory and Field Projects

1. *Types of work.*

The laboratory and field projects constitute one of the most vital features of the course. Teachers should plan to do a large amount of this work. No course should be given without doing some of it. Six types of these projects have been provided, which may be classified as follows:

I. Schoolroom projects.
   1. Laboratory projects.
      Example: To study and test thermometers. Page 23.
   2. Demonstration projects.
      Example: To show how to use a camera. Page 131.
   3. School projects.
      Example: To make the schoolroom attractive by means of house plants. Page 141.

II. Projects outside of schoolroom.
   1. Home projects.
      Example: To make a study of the heating system used in your home. Page 11.
   2. Community projects.
      Example: To investigate local health conditions with reference to water, milk, and foods. Page 363.
   3. Field projects.
      Example: To learn what shade trees are growing in your town and if they are properly cared for. Page 484.

The demonstrations are to be done before the class either by the instructor or by some pupil. It is intended that the laboratory projects shall be performed by each pupil or by a group of pupils. The extent to which it is advisable for each pupil to do the laboratory projects depends partly on the equipment and the facilities available for individual work. If space or duplicate equipment are lacking, the laboratory projects may be performed as demonstrations.

One hundred and thirty two projects are provided. These are more than can be done in a year, but the large number from which choice may be made insures that some projects may be found that are adapted to every type of school.

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2. *Adaptation to number of periods devoted to these projects.*

A. Projects for one period weekly.

When one period weekly is devoted to this type of work, the following projects are suggested.

a. For city schools.

Laboratory Projects.

Pages 35, 51, 75, 105, 132, 155, 290, 293, 377, 452, 487.

Demonstration Projects.

Pages 7, 17, 25, 106, 127, 260, 289, 382, 432, 439.

School Projects.

Pages 97, 141, 442.

Home Projects.

Pages 11, 27, 42, 77, 87, 96, 147, 159, 521.

Community Projects.

Pages 363, 425, 493.

Field Projects.

Pages 282, 451, 484, 532.

b. For town and rural schools.

Laboratory Projects.

Pages 35, 51, 75, 105, 187, 189, 293, 404, 452, 467.

Demonstration Projects.

Pages 7, 18, 37, 47, 113, 127, 355, 382, 407, 432, 438.

School Projects.

Pages 97, 141, 179.

Home Projects.

Pages 11, 27, 87, 96, 141, 147, 172, 200, 234, 237.

Community Projects.

Pages 415, 476.

Field Projects.

Pages 166, 194, 468, 282, 532.

B. Exercises for two periods weekly.

a. For city schools.

Those already given for one period and in addition the following:

Laboratory Projects.

Pages 14, 23, 69, 101, 102, 114, 116, 158, 263, 512, 513.

Demonstration Projects.

Pages 10, 13, 18, 22, 124, 131, 278, 302, 339, 381, 407.

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School Projects.
Pages 143, 146, 485.
Home Projects.
Pages 31, 40, 57, 77, 113, 141.
Community Projects.
Page 392.
Field Projects.
Pages 177, 341, 468.

b. For town and rural schools.
Those already given for one period and in addition the following:
Laboratory Projects.
Pages 14, 41, 69, 101, 114, 116, 167, 290, 377, 487, 513.
Demonstration Projects.
Pages 13, 17, 22, 106, 131, 289, 302, 339, 439.
School Projects.
Pages 235, 442, 485.
Home Projects.
Pages 31, 77, 113, 178, 201, 209, 521.
Community Projects.
Pages 405, 425.
Field Projects.
Pages 177, 461, 484.
If three periods are devoted weekly to laboratory and field work, practically all the projects can be carried out.

3. *Projects for schools with limited facilities.*

The author wishes to call special attention to the value of those projects that may be carried on outside of the schoolroom. The greatest value of this type of work lies in the fact that it connects school work with real life, because these studies are made under life conditions. In the second place, this type of work helps solve the problem of the expense involved in securing apparatus since it takes things as they are and studies science in life as it actually exists in the home and community. Hence this type of work is especially adapted for those small schools which are limited in laboratory facilities and equipment.

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A. Projects requiring no laboratory facilities.

Home Projects.

On pages 11, 27, 31, 40, 42, 57, 77, 87, 96, 109, 113, 141, 147, 159, 172, 178, 192, 200, 201, 209, 213, 219, 234, 237, 238, 521.

Community Projects.

On pages 363, 392, 405, 415, 425, 476, 493.

Field Projects.

On pages 166, 177, 194, 227, 253, 282, 341, 451, 461, 468, 484, 532.

School Projects.

On pages 97, 442.

B. Projects requiring only the simplest apparatus.

The projects here listed require only such simple apparatus as may be obtained from the pupils' homes or from the school equipment usually provided for the work in the other sciences. These projects may be performed either as demonstrations or as individual laboratory exercises.

Projects on pages 7, 14, 16, 17, 18, 23, 35, 37, 51, 69, 75, 101, 105, 116, 127, 141, 143, 167, 176, 187, 189, 192, 196, 235, 289, 290, 293, 296, 302, 377, 382, 391, 404, 432, 439, 452, 467, 485, 487, 513.

4. *Cost of apparatus.*

In making out the following lists of estimates only approximate figures can be given because prices are undergoing constant fluctuations. These figures are based on prices quoted early in 1920.

Set 1. Approximate cost, $50.00

This outfit includes only one set of material, and hence does not allow individual laboratory work (except with very small classes), but includes enough material to perform the individual exercises as demonstrations, excepting those requiring the more expensive apparatus listed below under set 3. Following is a list of the apparatus included in the above estimate:

Apparatus

Flasks, rubber stoppers, glass tubing, rubber tubing, alcohol lamp or Bunsen burner, tumblers, beakers, lamp chimney, test tubes, touch

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paper, candle, ringstand, thermometer, pneumatic trough, wide mouthed bottles, iron picture wire, deflagrating spoon, wire gauze, plates, bicycle pump, kerosene lamp, plates of glass, rubber membrane, pint milk bottle, glass model of pump, tin cup, red and blue litmus paper, tuning fork, convex and concave lenses, printing frame, printing papers, flowerpots, window boxes, bulbs, two bar magnets, horseshoe magnet, iron filings, small pieces of various metals, darning and knitting needles, insulated wire, large bolt, dry cells, electric bell, push button, sal ammoniac cell, strips of sheet zinc and copper, compass, rulers, insect breeding cage, outfit for candling eggs, collection of types of bird houses, galvanometer, small motor and dynamo, coffee pot, small gyroscope, spring balance, overflow can, catch bucket, shot, thistle tube, pipette, petri dishes, culture medium, Snellen's vision chart, collections of samples of woods, weather maps.

Chemicals

Nitric acid, hydrochloric acid, sulfuric acid, ammonia, limewater, potassium chlorate, manganese dioxid, sulfur, calcium carbide, distilled water, potassium permanganate, silver nitrate, calcium sulfate, potassium bromide, lead acetate, iron alum, iodin solution, granulated zinc, hypo, developing powders, formalin, baking powder, baking soda, cream of tartar, vinegar, salt, washing soda.

Set 2. Approximate cost, $100.00

This set includes enough duplicate material of apparatus listed in set 1 for a class of thirty to do individual laboratory exercises, as well as the simpler demonstrations. This estimate does not mean that enough duplicate material is provided so that all members of the class shall be working on the same experiment at the same time. Such an arrangement is not necessary, nor perhaps desirable. In making the above estimate it is assumed that different members of the class will be working on several different projects during the same period. In some cases small groups of pupils may work together with one set of apparatus.

Set 3. Approximate Cost, $225.00

This outfit includes sufficient material to do all the practical work outlined in the book. It includes the material listed under set 2 and

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in addition the following more expensive apparatus needed for some of the demonstrations:

Sling psychrometer, air pump, bell jar with open top, sonometer, camera, kodak film tank, pair of field glasses for bird study, model of steam engine, primary and secondary coils (the inner one removable) small gas engine or a model of one, induction coil, set of telegraph instruments (sender, sounder, relay), small demonstration form of wireless outfit, dissectible telephone, aneroid barometer.

5. *Complete list of projects given in book.*

I. Schoolroom Projects

A. Laboratory Projects

1. To study the burning of wood, soft coal, and hard coal. Page 14.
2. To compare safety matches and ordinary matches. Page 16.
3. To study and test thermometers. Page 23.
4. To study the burning of a candle. Page 35.
5. To find out what conditions are needed to keep a candle burning. Page 35.
6. To generate acetylene. Page 41.
7. To show that air has weight and hence exerts pressure. Page 51.
8. To show how a pump works. Page 52.
9. To test foods for different kinds of nutrients. Page 59.
10. To compare foods as regards their nutritive value. Page 69.
11. To find out which are the cheapest foods and which are the most expensive. Page 75.
12. To study the action of baking powder and yeast. Page 101.
13. To study the working of a Bunsen burner. Page 102.
14. To study the principles involved in freezing ice cream. Page 105.
15. To study the action of some substances used in the kitchen. Page 114.
16. To learn the effect of soap on hard water. Page 116.
17. To show the effect of light on certain salts of silver. Page 132.
18. To study the working of an electric bell. Page 155.
19. To learn how the cell used to operate the electric door bell is made. Page 158.
20. To make a plan for the ornamentation of the home yard. (Late winter or early spring.) Page 167.

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21. To make a plan of a flower garden. (Late winter or early spring.) Page 176.
22. To make a plan of a vegetable garden. Page 187.
23. To test the seeds you are going to plant in your garden. Page 189.
24. To study the activities of some garden insects. Page 196.
25. To study some types of bird houses. Page 234.
26. To study the parts of a steam engine. Page 253.
27. To see how the motor works. Page 263.
28. To study the action of the compass. Page 290.
29. To see how a gyroscope works. Page 292.
30. To learn why a boat floats. Page 293.
31. To test foods for adulterants. Page 359.
32. To observe the effect of anti-toxin treatment for diphtheria on the death rate in New Jersey. Page 377.
33. To compare the death rates for various diseases. Page 391.
34. To study the life history of the mosquito and to find methods of destroying it. Page 404.
35. To illustrate why we seem to see a continuous set of pictures at the movies. Page 452.
36. To study the food habits of some common birds. Page 467.
37. To learn to tell the cuts of wood found in chairs and tables. Page 487.
38. To keep a record of weather conditions by means of instruments. Page 512.
39. To learn how one may foretell the weather by a study of weather maps. Page 513.

B. Demonstration Projects

1. To study the principles applied in the hot-air furnace. Page 7.
2. To study the principles applied in hot-water heating. Page 8.
3. To learn the source of heat in the steam-heating system. Page 10.
4. To prepare oxygen and study its properties. Page 13.
5. To study the composition of air. Page 17.
6. To learn how the air we breathe out differs from the air we breathe in. Page 18.
7. To learn the conditions necessary for a change of air in ventilation. Page 22.
8. To find the humidity of the room. Page 25.

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9. To study the structure and workings of a kerosene lamp. Page 37.
10. To test the purity of drinking water. Page 47.
11. To show that air has weight. Page 51.
12. To study the activities of bacteria and some means of controlling them. Page 106.
13. To show how to can fruits and vegetables. Page 113.
14. To study some of the principles underlying the use of musical instruments. Page 124.
15. To show how a camera forms images. Page 127.
16. To show how to use a camera. Page 131.
17. To show how to develop films in the kodak film tank. Page 135.
18. To show how to print pictures. Page 136.
19. To illustrate the principle of the dynamo. Page 260.
20. To show how the gas engine works. Page 278.
21. To make a simple steam turbine. Page 289.
22. To see how the submarine is made to rise and sink. Page 296.
23. To illustrate the principle of the balloon. Page 302.
24. To show how a set of telegraph instruments works. Page 326.
25. To show how the wireless telegraph works. Page 331.
26. To study the working of the telephone. Page 339.
27. To see which kinds of water contain the fewest bacteria. Page 351.
28. To compare the cleanliness of milk from different sources by estimating the number of bacteria in a cubic centimeter (cc.). Page 355.
29. To see under what conditions air contains the fewest bacteria. Page 367.
30. To see if ice contains bacteria. Page 381.
31. To try the effect of pasteurization on the keeping quality of milk. Page 382.
32. To show that flies carry bacteria. Page 407.
33. To see if the ventilating system of your school furnishes the essentials of good ventilation. Page 432.
34. To test the eyes of the members of the class. Page 438.
35. To illustrate the working of the eye. Page 439.
36. To find the height of a hill by means of a barometer. Page 510.

C. School Projects

1. To form a League of Modern Health Crusaders. Page 97.

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2. To make the schoolroom attractive by means of house plants. Page 141.
3. To raise cuttings to take home. Page 143.
4. To supply the rooms in the school with flowers during the winter. Page 146.
5. To beautify the school grounds. Page 179.
6. To raise seedlings of some vegetables in the schoolroom so they may be taken home and planted in your gardens. Page 192.
7. To put up nesting boxes for birds in the school yard. Page 235.
8. To make a sanitary survey of the school. Page 442.
9. To make an exhibit of leaves of trees, to which you may invite your friends. Page 485.

II. Projects Outside of Schoolroom

A. Home Projects

1. To make a study of the heating system used in your home. Page 11.
2. To learn if your home is properly ventilated. Page 27.
3. To make a ventilating screen. Page 31.
4. To make a sleeping porch. Page 31.
5. To read the gas meter and learn the weekly cost of the gas used. Page 40.
6. To read the electric meter and compute the weekly cost of electricity. Page 42.
7. To read the water meter and compute the weekly cost of water. Page 57.
8. To store eggs for winter use. Page 77.
9. To distinguish fresh from stale eggs. Page 77.
10. To find out if you are eating the right kind and amount of food. Page 87.
11. To practice daily the proper health habits. Page 96.
12. To dry fruits and vegetables at home. Page 109.
13. To can fruits and vegetables. Page 113.
14. To beautify the home by means of house plants. Page 141.
15. To raise a Chinese lily for a Christmas present. Page 147.
16. To study the parts of an electric door bell outfit, so as to fix it if it gets out of order. Page 159.

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17. To plant bulbs in the home yard so as to get flowers during the spring. Page 172.
18. To beautify the home grounds by growing ornamental plants. Page 178.
19. To raise some early vegetables. Page 192.
20. To raise vegetables. Page 200.
21. To test different varieties of some one kind of vegetable. Page 201.
22. To raise tomatoes for canning. Page 201.
23. To raise fall strawberries. Page 209.
24. To raise fruits in the home yard. Page 213.
25. To take charge of a small flock of chickens. Page 219.
26. To make a nesting house for birds to put in your home yard. Page 234.
27. To feed the winter birds. Page 237.
28. To provide water for the birds. Page 238.
29. To observe the moon's changes for a month. Page 521.

B. Community Projects

1. To investigate local conditions with reference to water, milk, and foods. Page 363.
2. To study the death rate in your own state and locality for different diseases. Page 392.
3. To see what the class can do to help rid the locality of mosquitoes. Page 405.
4. To learn what the class can do to help control the fly nuisance. Page 415.
5. To study the duties of the local health officer. Page 425.
6. To see what the class can do to help protect the valuable birds found in the locality. Page 476.
7. To learn the value of your city parks. Page 493.

C. Field Projects

1. To study those shrubs and vines that are adapted for growing in the home grounds. Page 166.
2. To identify some of the cultivated flowers and to note their attractive features. Page 177.
3. To identify the most common weeds found growing in vegetable gardens. Page 194.

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'o see how many birds you can recognize from their song
'age 227.
'o see how the locomotive works. Page 253.
'o study the parts of an automobile and see how it is ru
'age 282.
'o visit the central telephone office. Page 341.
'o visit a moving picture theater to see how the projecti
pparatus works. Page 451.
'o see how many times nestling birds are fed in one day. Page 4
'o learn what beneficial birds are common in your locali
'age 468.
'o learn what shade trees are growing in your town and if th
re properly cared for. Page 484.
'o learn to name some of the common constellations. Page 5

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